IN THE DRAWINGS:

Submitted herewith are replacement sheets for Figs. 2 and 15 incorporating revisions to overcome the drawing objections. More specifically, Fig. 2 has been revised to delete reference numeral 17 and Fig. 15 has been amended to change "104" to "109" to conform to the description in the specification.

REMARKS

In the last Office Action, the Examiner objected to the drawings and claims as containing informalities. Claims 1-5 and 7-14 were rejected under 35 U.S. §112, second paragraph, for indefiniteness. Claim 6 was rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent Application Publication No. US 2002/0172589 A1 to Yamashita et al. ("Yamashita"). Claims 1-3 and 7 were rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,485,254 to Davis. Claims 4-5 and 8-14 were indicated to be allowable if rewritten to overcome the rejection under 35 U.S.C. §112, second paragraph, and to include all of the limitations of the base and intervening claims.

Applicants and applicants' counsel note with appreciation the indication of allowable subject matter concerning claims 4-5 and 8-14. However, for the reasons noted below, applicants respectfully submit that amended claims 2, 3, 6 and 7 and newly added claims 15-21 also patentably distinguish from the prior art of record.

In accordance with the present response, the specification has been suitably revised to correct informalities, provide antecedent basis for the claim language, and bring it into better conformance with U.S. practice. The title of the invention has been changed to

"MOLECULAR PUMP EQUIPPED WITH FLANGE HAVING BUFFERING PORTION" to more clearly reflect the invention to which the amended and new claims are directed. A new, more descriptive abstract has been substituted for the original abstract.

Original claim 2 has been amended to incorporate the subject matter of independent claim 1, which has been canceled, and to further patentably distinguish from the prior art of record. Independent claim 6 has been amended to further patentably distinguish from the prior art of record. The original claims, including allowable claims 4-5 and 8-14, have been further amended in formal respects to improve the wording and to bring them into better conformance with U.S. practice. Claims 2-5 and 7-14 have also been amended to overcome the rejection under 35 U.S.C. §112, second paragraph. New claims 15-21 have been added to provide a fuller scope of coverage.

Submitted herewith are replacement sheets for Figs. 2 and 15 incorporating revisions to overcome the drawing objections. More specifically, Fig. 2 has been revised to delete reference numeral 17 and Fig. 15 has been amended to change "104" to "109" to conform to the description in the specification.

In view of the foregoing, applicants respectfully submit that the objections to the drawings and claims and the rejection under 35 U.S.C. §112, second paragraph, have been overcome and should be withdrawn.

Brief Summary of the Invention

The present invention is directed to a molecular pump equipped with a flange having a buffering portion.

As described in the specification (pgs. 1-5), a conventional molecular pump has a flange at a gas inlet port for connection to a confronting flange of a vacuum vessel using fasteners (e.g., bolts) passing through apertures formed in the confronting flanges. However, the shock absorbing properties of the flange and fasteners in the conventional molecular pump are inferior in that they rely primarily on the tightening state of the fasteners. While various shock absorbing mechanisms have been proposed for the conventional molecular pump, all have proved to be complex in construction and expensive to manufacture.

The present invention overcomes the drawbacks of the conventional art. Figs. 1-3 show an embodiment of a molecular pump 1 according to the present invention embodied in the claims. The molecular pump 1 has a casing 16 having a gas inlet port 6 and a gas discharge port 19. Disposed within the casing 16 are a stator (e.g., 5, 22), a shaft 11 disposed in the casing 16 and concentrically with the stator, a bearing 8 rotatably supporting the shaft 11 for undergoing rotation relative to the stator in a preselected direction of rotation, a rotor 24 mounted on the shaft 11 for rotation therewith in the preselected direction of rotation, and a motor 10 for rotationally driving the shaft 11. A flange 61 is connected to the casing 16 at the gas inlet port 6.

According to the present invention, the flange 61 has mounting holes 14 each for receiving a fastener (e.g., a bolt) and a buffering portion for undergoing deformation due to a shock resulting from a torque acting on the casing 16 in the preselected direction of rotation. The buffering portion has deformable thin-wall portions 71 disposed adjacent to the respective mounting holes 14 in a direction opposite to the preselected direction of rotation.

In another embodiment, as shown in Figs. 18(a)-18(b), the flange 61p has at least one mounting hole 14 for receiving a fastener, a first elongated through-hole 134 disposed in communication with the mounting hole 14, and a second elongated through-hole 130 spaced apart from the first elongated through-hole 134 in a direction toward a direction of rotation C opposite to the preselected direction of rotation to define between the first and second elongated through-holes 134, 130 a deformable thin-wall portion 132 for undergoing deformation due to a shock resulting from a torque acting on the casing 16 in the preselected direction of rotation.

By the foregoing construction, shock resulting from a torque acting on the casing of the molecular pump in the preselected direction of rotation (i.e., the direction of rotation of the rotor) is effectively absorbed by deformation of the thin-wall portions disposed adjacent to the respective mounting holes (Fig. 3) or defined between the first and second elongated through-holes (Figs. 18(a)-18(b). Since the thin-wall portions constitute part of the flange, sufficient shock absorption can be obtained irrespective of the internal structure of the molecular pump. Thus, the molecular pump according to the present invention provides a flange with a buffering portion which is simple in construction and economic to manufacture as compared to the conventional art.

Traversal of Prior Art Rejections

Claim 6 was rejected under 35 U.S.C. §102(e) as being anticipated by Yamashita. Applicants respectfully traverse this rejection and submit that amended claim 6 recites subject matter which is not identically disclosed or described in Yamashita.

Amended independent claim 6 is directed to the combination of a molecular pump comprised of a casing having a gas inlet port and a rotor mounted in the casing for undergoing rotation in a preselected direction of rotation, and flange for connecting the gas inlet port of the molecular pump to an evacuating port of a vacuum vessel. Claim 6 recites that the flange comprises a plurality of mounting holes each for receiving a fastener for connecting the flange to the vacuum vessel, and a plurality of deformable thin-wall portion disposed adjacent to the respective mounting holes in a direction opposite to the preselected direction of rotation of the rotor for undergoing deformation due to a shock resulting from a torque acting on the casing in the preselected direction of rotation. No corresponding structural and functional combination is disclosed or described by Yamashita.

Yamashita discloses a vacuum pump having a flange 20 with mounting holes 26, 28 (first and second bolt insertion holes) adapted to receive bolts 38, 40 for mounting the flange 20 to another flange 22 (Figs. 1 and 4B). The mounting holes 26, 28 are spaced apart by a portion of the flange 20. When an abnormality of the vacuum pump in Yamashita occurs so as to cause damage to a rotor 9, a torque F (Fig. 4B) is generated in a case 1, and an instantaneous shearing force acts on each of the fastening bolts 38 (paragraph [0042]). When the fastening bolts 38 are damaged, the flange 20 moves by a clearance of the mounting holes 28 to reduce a damaging energy. Consequently, the flange 20 hits on the fastening bolts 40 to the extent the fastening bolts are damaged (e.g., sheared) (paragraph [0043]).

Thus, contrary to the Examiner's contention, the portion between mounting holes 26, 28 in Yamashita does not undergo deformation, as required by the thin-wall portions of the flange recited in amended independent claim 6, during generation of the torque F. As described above, it is the fastening bolts 38, 40 in Yamashita (i.e., not thin-wall portions of the flange) which are subjected to deformation (paragraph [0043], lines 6-8) for the purpose of absorbing the impact during generation of the torque F.

In the absence of the foregoing disclosure recited in amended independent claim 6, anticipation cannot be found. See, e.g., W.L. Gore & Associates v. Garlock, Inc., 220 USPQ 303, 313 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984) ("Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration"); Continental Can Co. USA v. Monsanto Co., 20 USPQ2d 1746, 1748 (Fed. Cir. 1991) ("When more than one reference is required to establish unpatentability of the claimed invention anticipation under § 102 can not be found".); Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., 221 USPQ

481, 485 (Fed. Cir. 1984) (emphasis added) ("Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim").

Stated otherwise, there must be no difference between the claimed invention and the reference disclosure, as viewed by a person of ordinary skill in the field of the invention. This standard is clearly not satisfied by Yamashita for the reasons stated above. Furthermore, Yamashita does not suggest the claimed subject matter and, therefore, would not have motivated one skilled in the art to modify Yamashita's vacuum pump to arrive at the claimed invention.

In view of the foregoing, applicants respectfully request that the rejection of claim 6 under 35 U.S.C. §102(e) as being anticipated by Yamashita be withdrawn.

Claims 2-3 and 7 were rejected under 35 U.S.C. §102(e) as being anticipated by Davis. Applicants respectfully traverse this rejection and submit that amended claims 2-3 and 7 recite subject matter which is not identically disclosed or described in Davis.

Claim 2 has been rewritten in independent form to incorporate the subject matter of independent claim 1, which has been canceled, and to further patentably distinguish from

Davis. Claim 2 requires a molecular pump having a flange connected to the casing at the gas inlet port, the flange having a plurality of mounting holes each for receiving a fastener and a buffering portion for undergoing deformation due to a shock resulting from a torque acting on the casing in the preselected direction of rotation, the buffering portion having a plurality of deformable thin-wall portions disposed adjacent to the respective mounting holes in a direction opposite to the preselected direction of rotation. No corresponding structure is disclosed or described by Davis.

Davis discloses an energy dissipating coupling comprising a first ring 302 disposed proximate a second ring 330 and an energy dissipating media 360 disposed between the first and second rings 302, 330 (Fig. 3).

However, Davis does not disclose or describe the specific structure of the flange recited in amended claim 2. More specifically, Davis does not disclose or suggest a flange having a plurality of mounting holes each for receiving a fastener and a buffering portion for undergoing deformation due to a shock resulting from a torque acting on the casing in the preselected direction of rotation, the buffering portion having a plurality of deformable thin-wall portions disposed adjacent to the respective mounting holes in a direction opposite to the preselected direction of rotation. In Davis, the buffering portion comprises an energy dissipating ring 360 disposed between the first and second rings 302, 330. While the energy dissipating ring 360 has cut-out sections forming thin-wall portions, such thin-wall portions are not disposed adjacent to the respective mounting holes in a direction opposite to the preselected direction of rotation (i.e., the direction of rotation of a rotor), as required by amended independent claim 2.

Since Davis does not disclose or describe the foregoing structure of the flange recited in amended claim 2, there can be no anticipation by Davis of independent claim 2 under 35 U.S.C. §102(e). That is, since each and every limitation of independent claim 2 is not found in Davis, the reference does not anticipate the claimed invention. See In re Lange, 209 USPQ 288, 293 (CCPA 1981). Furthermore, Davis does not suggest the claimed subject matter and, therefore, would not have motivated one skilled in the art to modify Davis' energy dissipating coupling to arrive at the claimed invention.

Claims 3 and 7 depend on and contain all of the limitations of amended independent claim 2 and, therefore, distinguish from Davis at least in the same manner as claim 2.

In view of the foregoing, applicants respectfully request that the rejection of claims 2, 3 and 7 under 35 U.S.C. §102(a) as being anticipated by Davis be withdrawn.

Applicants respectfully submit that new claims 15-21 also patentably distinguish from the prior art of record.

New independent claim 16 is directed to a molecular pump and requires a flange connected to the casing at the gas inlet port, the flange having at least one mounting hole for receiving a fastener, a first elongated through-hole disposed in communication with the mounting hole, and a second elongated through-hole spaced apart from the first elongated through-hole in a direction toward a direction of rotation opposite to the preselected direction of rotation to define between the first and second elongated through-holes a deformable thin-wall portion for undergoing deformation due to a shock resulting from a torque acting on the casing in the preselected direction of rotation. No corresponding structural combination is disclosed or suggested by the prior art of record.

Claims 15 and 17-21 depend on and contain all of the limitations of amended independent claim 2 and new independent claim 16, respectively, and, therefore, distinguish from the prior art of record at least in the same manner as claims 2 and 16.

In view of the foregoing amendments and discussion, the application is believed to be in allowable form. Accordingly, favorable reconsideration and allowance of the claims are most respectfully requested.

Respectfully submitted,

ADAMS & WILKS
Attorneys for Applicants

By: Bruce L. Adams
Bruce L. Adams
Reg. No. 25,386

50 Broadway
31st Floor
New York, NY 10004
(212) 809-3700

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Name

Debra Buonincontri
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MAY 16, 2005
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